

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

DEEP TILLAGE

(ACRES)

CODE 324

DEFINITION

Performing tillage operations below the normal tillage depth to modify the physical or chemical properties of a soil.

PURPOSES

This practice may be applied as part of a conservation management system to support one or more of the following:

- Fracture restrictive soil layers.
- Bury or mix soil deposits from wind or water erosion or flood overwash.
- Reduce concentration of soil contaminants, which inhibit plant growth.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to land having adverse soil conditions which inhibit plant growth, such as compacted layers formed by field operations, restrictive layers such as claypans, overwash or deposits from wind and water erosion or flooding, or contaminants in the root zone.

This standard includes tillage operations commonly referred to as deep plowing, subsoiling, ripping, or row-till, performed from time to time below the normal tillage depth.

CRITERIA

General Criteria Applicable to All Purposes

Deep tillage operations shall be performed when soil moisture is less than 30 percent of field capacity, according to the "feel test" or other acceptable method, at the maximum

depth to which the tillage will be done.

Optimum soil moisture conditions for chiseling or subsoiling generally occurs during August and September but may extend through October for Southern Maine.

Perform the last deep tillage operation on the contour or across the slope for areas steeper than two percent.

Power equipment should be adequately sized to perform chiseling or subsoiling at a ground speed of three to five miles per hour.

Additional Criteria to Fracture Restrictive Soil Layers

Tillage equipment such as chisels, subsoilers, bent-leg subsoilers, or rippers, with the ability to reach the required depth shall be used. Chiseling is used to fracture restrictive soil layers that are less than 16 inches deep. Subsoiling is used to fracture restrictive soil layers that are more than 16 inches deep.

The depth of tillage shall be a minimum of one inch deeper than the depth of the restrictive layer. Tillage depth should be set carefully and periodically checked to maintain this working depth.

Complete fracturing of the restrictive layer is not required. The fractured zone, as a minimum, shall be sufficient to permit root penetration below the restrictive soil layer. The fractured zone does not need to extend to the row middles and should be limited to the area near the rows [in the case of crops broadcast-planted or drilled in narrow rows (less than 15 inches), the fractured zone may be disrupted completely]. On excessively compacted soils, two passes through the field may be needed.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service. Contact Paul Hughes, NRCS Agronomist at 207-990-9562 or email comments and concerns to paul.hughes@me.usda.gov.

The second pass should be at an angle perpendicular to the first.

Fracturing restrictive layers is generally not needed every year. Identify those crops or times in the cropping sequence when restrictive layers should be fractured.

Chiseling or subsoiling to alleviate compaction needs to become part of a management system that includes crop rotation with organic matter improvement, minimum tillage passes with proper timing, drainage, and proper selection of tillage equipment.

Additional Criteria to Bury or Mix Soil Deposits from Wind and Water Erosion or Flood Overwash

Tillage equipment such as moldboard plows, disk plows or chisels with twisted points, with the ability to reach the required depth shall be used.

The tillage operation shall uniformly mix soil 6" or 2 times (2 X) the depth of overwash, whichever is deeper, to achieve a desired available water-holding capacity (AWC) and to break the hydrologic barrier caused by overwash layer.

Additional Criteria to Reduce Concentration of Soil Contaminants Which Inhibit Plant Growth

Tillage equipment such as moldboard plows, disk plows or chisels with twisted points, with the ability to reach the required depth shall be used.

The tillage operation shall mix a sufficient amount of uncontaminated soil with the contaminated material so that the concentration of the contaminant is below the crop tolerance level. Crop tolerance levels shall be established in accordance with University of Maine guidance and recommendations.

The soil contaminant shall be uniformly distributed throughout the deep tilled layer.

CONSIDERATIONS

Consider the stoniness of the subsoil before initiating subsoiling or chiseling.

Minimize mixing of deeper subsoil into the plow layer where soil fertility in the lower profile is significantly different than material near the soil surface.

Where restrictive layers are a concern, the effects of this practice can be enhanced by including deep rooted crops in the rotation that are able to extend to and penetrate the restrictive layer.

Research on numerous crops has shown that tillage conducted excessively deeper than the compacted layer does not promote increased yields, requires excessive amounts of tillage energy, and promotes future compaction from nearby vehicle traffic.

Reduce or control equipment traffic during periods when soils are prone to compaction and formation of tillage pans.

When infertile flood overwash is mixed with the pre-flood soil profile, the soil rebuilding process can be enhanced by additions of organic matter, such as manure or cover crops utilized as green manure. Crop rotations, tillage and planting systems, which maintain high levels of crop residues, such as no-till, can also accelerate this process.

Where the flood overwash layer is too thick to effectively mix with the pre-flood soil profile, redistribution of the overwash layer by smoothing or removal may be necessary. Generally, no more than about 6 inches of overwash can be uniformly mixed into the soil profile using commonly available equipment. Specialized equipment may be necessary where greater depths of overwash are to be incorporated.

Where unfavorable soil materials such as high sodium, calcium, gypsum or other undesirable materials, are within anticipated deep tillage depth and would be brought to the surface by deep tillage operations, this practice should not be applied.

Transport of sediment-borne pollutant(s) offsite can be reduced when this practice is used in a conservation management system, by reducing the concentration of pollutants in the surface layer. Chiseling may be used effectively to incorporate manure, sludge or other by-products and minimize nutrient losses caused by surface runoff and volatilization.

To help reduce compaction, it is desirable to conduct normal tillage operations when soil moisture is less than 50 percent of field capacity. When possible harvest operations should be avoided when soil moisture is greater than 50 percent of field capacity. Field harvest haul traffic should be limited to end rows or haul roads. Compacted regions between crop rows that are not fractured can assist in supporting vehicle traffic, limiting rutting and soil compaction beneath the row.

If application of this practice will impact cultural resources (Archaeological, historic, historic landscape, or traditional cultural properties), follow NRCS national policy and State operating procedures for considering cultural resources.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the Criteria, Considerations and Operations & Maintenance described in this standard.

OPERATION AND MAINTENANCE

Deep tillage for reduction of soil compaction shall be performed whenever compaction reoccurs.

When deep tillage has been performed to reduce the concentration of soil contaminants, the contaminate levels in the root zone shall be monitored to assist with determining when or if treatment will be reapplied.